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## CLAIMS

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[Claim(s)]

[Claim 1]A career cleaning method characterized by a thing of a wafer carrier which makes a semiconductor wafer arrange in parallel and accommodates it atomized and done to particle diameter of 50 micrometers or less for the high pressure jet of the penetrant remover at least at the whole inner surface.

[Claim 2]The career cleaning method according to claim 1 with which a penetrant remover contains a surface-active agent.

[Claim 3]The career cleaning method according to claim 1 or 2 whose injection pressure of a penetrant remover is 3 – 50MPa.

[Claim 4]The career cleaning method according to claim 1, 2, or 3 which turns a wafer carrier below and supports it from sideways so that a wafer carrier may be a box type and a penetrant remover injected by the career inner surface may be discharged in the serial exterior.

[Claim 5]A career washing station comprising:

A career support means which supports a wafer carrier which makes a semiconductor wafer arrange in parallel and accommodates it.

A penetrant remover jet means of a wafer carrier supported by this support means which atomizes and injects a penetrant remover to the whole inner surface at least.

[Claim 6]The career washing station according to claim 5 which possesses a driving means to which either [ at least ] a wafer carrier or cleaning liquid spray nozzles are moved making a washing part of a wafer carrier carry out the right opposite of the cleaning liquid spray nozzles, and keeping almost constant distance from a washing part to cleaning liquid spray nozzles.

[Claim 7]The career washing station according to claim 5 or 6 which a wafer carrier is a box type, and a career support means turns the wafer carrier below from sideways, and is supported.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the career cleaning method and device which fitted the inner face cleaning of the box type wafer carrier especially about the cleaning method and device of a wafer carrier which are made to arrange a semiconductor wafer in parallel and are accommodated.

[0002]

[Description of the Prior Art]In order to improve the productivity of the silicon wafer which is a raw material of a semiconductor device, development of the manufacturing technique of a 300-mm wafer is advanced to major-diameter-izing of the wafer, and a concrete target, according to this, a wafer carrier is also newly developed, and the standardization is also advanced.

[0003]Unlike the old object for wafers of 200 mm or less, it becomes in use box typing the wafer carrier used for a 300-mm wafer. That is, the box type with which the wafer carrier used for a 300-mm wafer can seal an inside is in use to the wafer carrier used for a wafer of 200 mm or less having an open rack form in use from which the bottom escaped.

[0004]If the air cleanliness class required of a wafer tends to become very high and tends to raise air cleanliness classes also including the transportation lines between down stream processing, this, If a box type wafer carrier is used to a highly efficient clean room being needed for vast area, and great cost starting, It is because it will become possible to reduce an air cleanliness class in the large conveyance area between devices and the cost merit will become very large, if even the air cleanliness class in a device is raised.

[0005]And as washing processing of a wafer carrier, brushing in a penetrant remover is validated, it divides to a wafer carrier conventional open rack type, and compound processing which combined the stream processing by making the penetrant remover overflow is made effective.

[0006]

[Problem(s) to be Solved by the Invention]However, to the wafer carrier of the box type used for a 300-mm wafer, it cannot say that just brushing processing in a penetrant remover is enough, and the effective cleaning method is not yet developed. The reason with brush washing unsuitable to a box type wafer carrier is as follows.

[0007]In a box type wafer carrier, it differs from an open rack type case, About stream washing what is called by overflow by which is swept, and a structure top is difficult for \*\*\*\* and it is combined with brushing processing which discharges the particle raked out by brushing out of a career, since water permeability is bad, a big effect is not expectable, either.

[0008]And although removing the particle of a 0.1-micrometer level from what on the box type career for 300-mm wafers in connection with the minuteness making of wiring structure is called for, In brushing washing, even if it combines the stream processing by overflow, only the particle to a 1-micrometer level is removable.

[0009]The purpose of this invention is to provide the career cleaning method and device which can secure easily Hajime Takatsugi's cleanliness required of the box type career for 300-mm wafers.

[0010]

[Means for Solving the Problem] To achieve the above objects, this invention persons did the comparative examination of various cleaning methods. As a result, although a physical cleaning means is indispensable, Just a pure mechanical cleaning means like brush washing is insufficient, It became clear that high pressure jet washing, especially high voltage particle jet washing which makes a penetrant remover a detailed drop and carries out high pressure jet have high validity, and that particle diameter had big influence on removal performance of particle by the high voltage particle jet washing.

[0011] This invention is completed based on this knowledge, and the career cleaning method is a thing of a wafer carrier which makes a semiconductor wafer arrange in parallel and accommodates it which atomizes and carries out high pressure jet of the penetrant remover to particle diameter of 50 micrometers or less at least at the whole inner surface.

[0012] A career washing station of this invention is provided with the following.

A career support means which supports a wafer carrier which makes a semiconductor wafer arrange in parallel and accommodates it.

a wafer carrier supported by this support means -- at least -- the inner surface whole -- a penetrant remover -- atomization and a penetrant remover jet means preferably atomized and injected in particle diameter of 50 micrometers or less.

[0013] Although a wafer carrier is mainly a box type, an open rack type may be used. In a box type case, it is preferred to turn the wafer carrier below sideways and to support it so that a penetrant remover injected by career inner surface may be discharged in the serial exterior.

[0014] When particle diameter of a penetrant remover exceeds 50 micrometers, 1 micrometer or less of particle cannot fully be removed. Since such small particle that particle diameter is small is removable, a minimum of particle diameter is not specified in particular. Especially desirable particle diameter is 10 micrometers or less.

[0015] An injection pressure of a penetrant remover has preferred 3 – 50MPa, and especially its 10 – 40MPa is preferred. If this pressure is small, sufficient detergency will not be obtained to a wafer carrier. Since pressure-proofing is increased when too large, a device becomes large-sized. There is a possibility of giving a wafer carrier a damage.

[0016] Composition to which cleaning liquid spray nozzles are moved is preferred, making a washing part of a wafer carrier carry out the right opposite of the cleaning liquid spray nozzles, and keeping constant distance from a washing part to cleaning liquid spray nozzles as composition of a penetrant remover jet means. It is also possible to move a wafer carrier with the movement instead of moving cleaning liquid spray nozzles.

[0017] It is preferred to add a surface-active agent to a penetrant remover. Because, wettability to a carrier surface and the quality of an affix of a penetrant remover becomes good with a surface-active agent, and a cleaning effect improves. In particular, particle removal of a 0.1-micrometer level has an effect.

[0018]

[Embodiment of the Invention] The embodiment of this invention is described based on a drawing below. Drawing 1 is an outline lineblock diagram of the career washing station in which one embodiment of this invention is shown, and an outline lineblock diagram of a driving means [ in / in drawing 2 / the career washing station ].

[0019] The wafer carrier 10 is a box type which aligns the 300-mm silicon wafer of two or more sheets in a thickness direction, and accommodates it. The bottom plate part 11 of the dome shape with which this career 10 curved in the direction of a convex below, The side wall parts 12 and 12 of the both sides which extended upwards from the edges-on-both-sides part of the bottom plate part 11, It consists of the end plate parts 13 and 13 which extend upwards from the wafer align direction both ends of the bottom plate part 11, and connect the side wall parts 12 and 12 of both sides, and two or more flutings 14 into which the edges-on-both-sides part of a wafer fits are formed in each inner surface of the side wall parts 12 and 12.

[0020] According to this embodiment, the above-mentioned wafer carrier 10 is supported in the cleaning tank 60 by the reversal posture which turned the opening caudad by the 1st driving means 40, it is in this state and the whole inner surface is washed by the penetrant remover jet

means 20.

[0021]The penetrant remover jet means 20 is provided with the air compressor 23 and the cleaning fluid tank 24 which were connected to the upstream of the pump 22 and the pump 22 which were connected to the cleaning liquid spray nozzles 21 attached to the 2nd driving means 50, and the nozzle 21 via the flexible pipe, A penetrant remover is atomized in particle diameter of 50 micrometers or less from the nozzle 21, and it injects by the pressure of 3 – 50MPa as the high voltage particle jet 30.

[0022]The 1st driving means 40 is provided with the following.

The zipper 41 which holds the wafer carrier 10 to reverse.

The actuator 42 which carries out the straight-line drive of the zipper 41 in the direction of X-Y. The nozzle supporter 51 which the 2nd driving means 50 penetrated the bottom center section of the cleaning tank 60, and was vertically inserted into the tub, Have the 1st actuator 52 that carries out the rectilinear-propagation drive of the nozzle supporter 51 at a Z direction, and the 2nd actuator 53 that rotates the actuator 52 in the direction of theta of the circumference of the Z-axis, and the nozzle supporter 51, The 3rd actuator 54 that is supporting the cleaning liquid spray nozzles 21 in the upper bed part, and rotates the nozzle 21 in the direction of alpha of the circumference of a horizontal axis is built in.

[0023]By 5 axis (X, Y, Z, theta, alpha) drive by the 1st driving means 40 and 2nd driving means 50, the cleaning liquid spray nozzles 21 can be moved to arbitrary positions by the inside of the wafer carrier 10, and can turn to arbitrary directions.

[0024]In washing processing, while the nozzle 21 injects the high voltage particle jet 30, the inside of a right-angled field is moved to a wafer align direction by the inside of the wafer carrier 10. The nozzle 21 carries out a right opposite to a career inner surface right-angled, and it is in the state where the distance L from a career inner surface was kept constant from the nozzle 21, and, more specifically, moves in the course top of the arrow in drawing 1.

[0025]That is, along with the fluting 14, it goes up from the position which carries out a right opposite to the opening edge of one [ 1 ] side wall part 12. 2) Move along with the inner surface R of the bottom plate part 11. 3) Descend to an opening edge along with the fluting 14 of the side wall part 12 of another side. This is performed to a wafer align direction (align direction of the fluting 14) a predetermined pitch every. Opposite direction movement may be combined every other time.

[0026]The moving pitch in a wafer align direction is suitably determined based on the relation between the alignment pitch of the fluting 14 in the wafer carrier 10, and the spreading angle of the high voltage particle jet 30 from the nozzle 21. Both relation is shown in drawing 5.

[0027]The alignment pitch of the fluting 14 is 10 mm by a SEMI standard. If the moving pitch in a wafer align direction shall be 10 mm, every one fluting 14 can be washed strictly, but throughput nature falls remarkably. the high voltage particle jet 30 injected from the nozzle 21 -- usually -- about 45 to 90 degrees -- it spreading, and, since it is, A high detergency is obtained in order that the high voltage particles 30 may collide with the both side surfaces of all the flutings 14, even if a moving pitch may be set up wash two or more flutings 14 at a time, for example, it makes it move every 50 mm. If two or more nozzles 21 are arranged to the align direction of the fluting 14, throughput nature will improve further.

[0028]The particle of a 0.1-micrometer level is also removed from the whole inner surface of the wafer carrier 10 by such high voltage particle jet washing processing. That is, detailed particle is removed by the high voltage particle jet 30 which atomized [ 1st ] the penetrant remover in particle diameter of 50 micrometers or less. In the portion of the fluting 14, a shadow (dead angle) does not arise [ 2nd ] by moving the nozzle 21 carrying out a right opposite to a career inner surface right-angled. When the nozzle 21 moves in the direction of the fluting 14, it sweeps out and an effect is acquired [ 3rd ]. Since the wafer carrier 10 is for back, to the exterior, the penetrant remover injected by the inner surface is discharged efficiently, and sweeps out, and an effect is puffed [ 4th ] up.

[0029]Since it is usually that the cleanliness like an inner surface is not required from the outside surface of the wafer carrier 10, Although usual jet washing, shower washing, etc. may be sufficient and the cleaning method in particular is not limited, naturally washing with the high

voltage particle jet which atomized the penetrant remover in particle diameter of 50 micrometers or less may be used like an inner surface.

[0030]The outline perspective view and drawing 4 which show the composition of a driving means to the Lord of a career washing station who shows the embodiment of everything [ drawing 3 ] but this invention are a mimetic diagram showing the moving track of the nozzle by the driving means.

[0031]The career washing station of this embodiment is used for washing of the open rack type wafer carrier 10. This wafer carrier 10 consisted of the side wall parts 12 and 12 of both sides, and the end plate parts 13 and 13 which connect the side wall parts 12 and 12 of both sides, and has opened the upper surface and the undersurface wide. The side wall parts 12 and 12 of both sides are being displaced to the inside in the lower part for wafer support, and two or more flutings 14 into which the edges-on-both-sides part of a wafer fits are formed in each inner surface of the side wall parts 12 and 12.

[0032]And on the buck 61 in the cleaning tank 60, this wafer carrier 10 turns a top opening upwards, is laid, and has a flange of an upper bed fixed by the electrode holders 62 and 62 of both sides.

[0033]The cleaning liquid spray nozzles 21 of the penetrant remover jet means 20 are supported by the driving means 70 from the upper part. This driving means 70 is provided with the following. The 1st horizontal arm 71B by which a rise-and-fall drive is carried out by the 1st motor 71A at a Z direction.

The 2nd horizontal arm 72B by which is connected with the tip part of the 1st horizontal arm 71B, and a turning drive is carried out to the circumference of a vertical axis (theta1 direction) by the 2nd motor 72A.

The 3rd horizontal arm 73B by which is connected with the tip part of the 2nd horizontal arm 72B, and a turning drive is carried out to the circumference of a vertical axis (theta 2-way) by the 3rd motor 73A.

The vertical nozzle supporter 75B which connects with the tip part of the 3rd horizontal arm 73B, and is rotated to the circumference of a vertical axis (theta3 direction) by the 4th motor 74A.

The nozzle supporter 75B supports the nozzle 21 in a lower end part, and rotates the nozzle 21 to the circumference of a horizontal axis (the direction of alpha) by the 5th motor 75A. And the 1st motor 71A, the 2nd motor 72A, and the 3rd motor 73A carry out position control of the nozzle 21 in the direction of X-Y-Z, and the 4th motor 74B and the 5th motor 75A perform the attitude control of nozzle 21 the very thing.

[0034]According to this driving means 70, the right opposite of the nozzle 21 is carried out to a carrier surface right-angled, and it is in the state where the distance L to a carrier surface was kept constant, and moves to the order shown in drawing 4 by 1-9. That is, after moving to an upper bed part from the lower end part of the outside surface of one side wall part 12 of the wafer carrier 10, it moves to a lower end part from the upper bed part of the inner surface of the side wall part 12. Then, after moving to an upper bed part from the lower end part of the inner surface of the side wall part 12 of another side of the wafer carrier 10, it moves to a lower end part from the upper bed part of the outside surface of the side wall part 12.

[0035]The side wall parts 12 and 12 of the both sides of the wafer carrier 10 are continuously washed with the high voltage particle jet 30 per predetermined region of a wafer align direction by movement of such a nozzle 21. By repeating this a predetermined pitch every to a wafer align direction, the whole internal and external surfaces of the side wall parts 12 and 12 of both sides are washed efficiently.

[0036]When this embodiment also arranges in parallel two or more cleaning liquid spray nozzles 21 in a wafer align direction, it cannot be overemphasized that throughput nature is further improvable.

[0037]

[Effect of the Invention]As explained above the career cleaning method and device of this invention, By carrying out minuteness making of the penetrant remover, and using high voltage particle jet washing which carries out high pressure jet, Hajime Takatsugi's satisfying washing

can be easily carried out also to the box type career for 300-mm wafers of which difficult and cleanliness higher than the existing level is required, without application of the existing cleaning method using complicated and large-sized equipment.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is an outline lineblock diagram of the career washing station in which one embodiment of this invention is shown.

[Drawing 2]It is an outline lineblock diagram of the driving means in the career washing station.

[Drawing 3]It is an outline perspective view showing the composition of a driving means to the Lord of a career washing station who shows other embodiments of this invention.

[Drawing 4]It is a mimetic diagram showing the moving track of the nozzle by the driving means.

[Drawing 5]It is a top view showing the relation between the alignment pitch of the fluting in a wafer carrier, and the spreading angle of the high voltage particle jet from a nozzle.

[Description of Notations]

10 Wafer carrier

20 Penetrant remover jet means

21 Nozzle

30 High voltage particle jet

40, 50, and 70 Driving means

60 Cleaning tank

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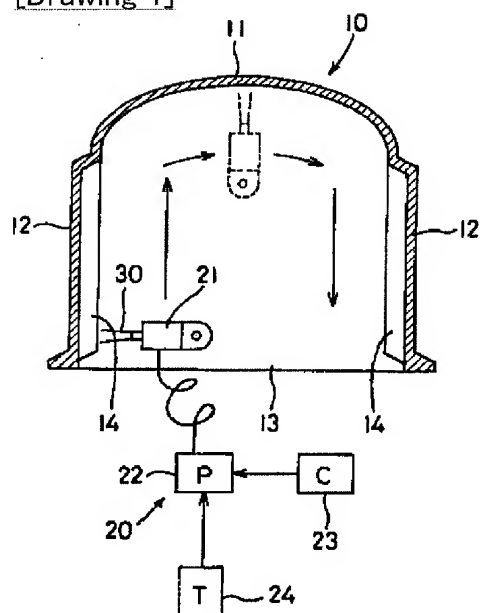
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DRAWINGS

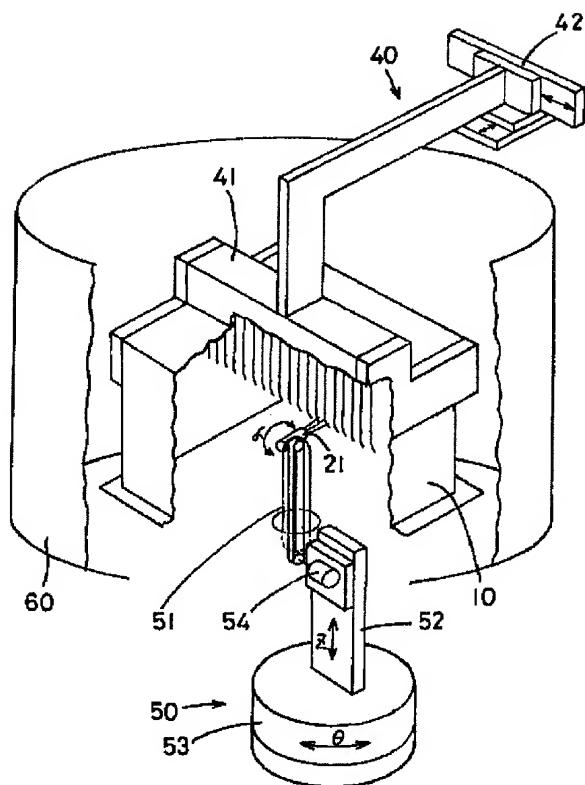
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[Drawing 1]

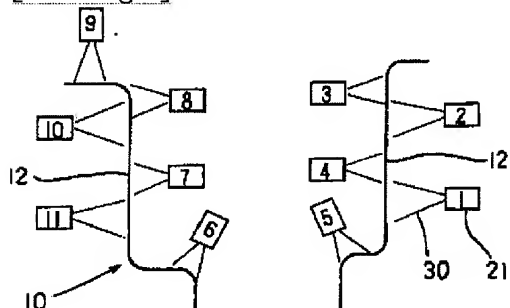


[Drawing 2]

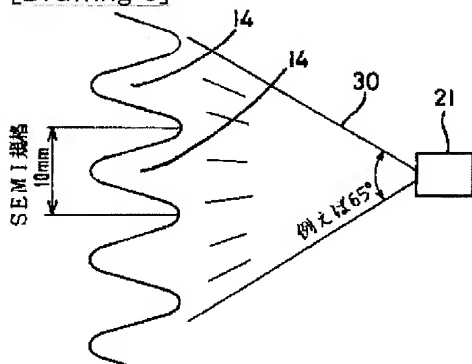




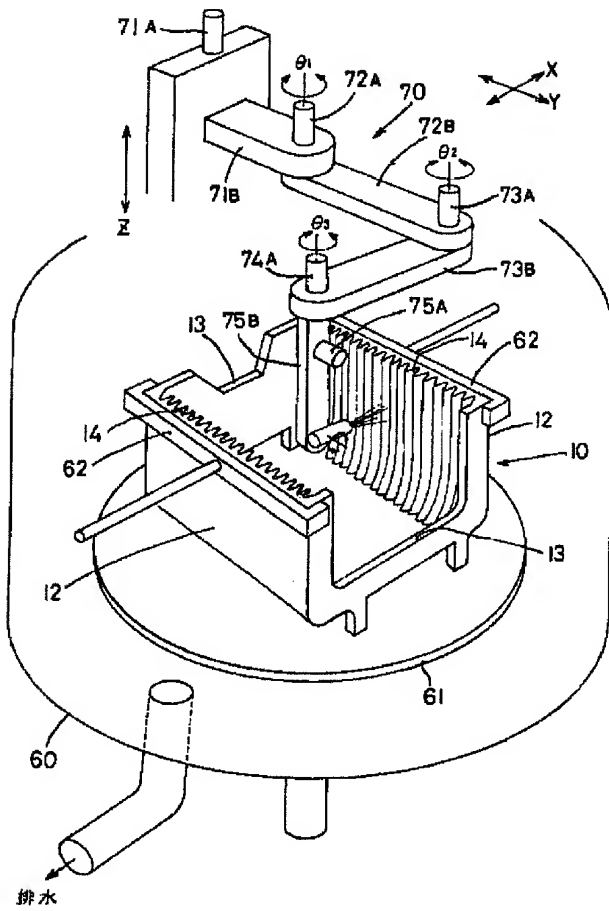
[Drawing 4]



[Drawing 5]



[Drawing 3]



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